Depression and Anxiety as Risk Factors for Delayed Care-Seeking Behavior in Human Immunodeficiency Virus–Infected Individuals in South Africa

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Background. Facility- and community-based efforts to improve human immunodeficiency virus (HIV) testing in sub-Saharan Africa may benefit from understanding how mental health influences HIV care-seeking behavior.

Methods. We conducted a study among adults presenting for HIV testing in the Umlazi township of South Africa. Prior to testing, we measured depression using the 9-item Patient Health Questionnaire and anxiety using the 7-item Generalized Anxiety Disorder scale. We categorized patients as delayed presenters (presenting to clinic >3 months after first HIV-positive test), late testers (presenting within 3 months of diagnosis with a CD4 count ≤200 cells per µL), or neither. We used multinomial logistic regression adjusting for sociodemographic and behavioral characteristics to determine the effects of depression and anxiety on HIV care-seeking behavior.

Results. Among 1482 HIV-infected adults, 59% were female and mean age was 33 years. The prevalence of depression in the cohort was 33% and anxiety was 9%. In adjusted models, mild to moderate depression was not associated with delayed presentation or late testing. HIV-infected adults with severe depression had 3.6 greater odds (95% confidence interval [CI], 1.2–10.2) of delayed presentation and 2.2 greater odds (95% CI, 1.01–4.8) of late testing compared with those without depression. Individuals with generalized anxiety had 2.3 greater odds (95% CI, 1.3–4.2) of delayed presentation compared with those without anxiety.

Conclusions. Severe depression was associated with delayed presentation and late testing, while anxiety was associated only with delayed presentation. Screening for mental health services may improve antiretroviral therapy initiation and linkage to care following HIV testing.

Keywords. HIV/AIDS; delayed presenters; late testers; depression; anxiety.

Half of the estimated 36 million people living with human immunodeficiency virus (PLWH) worldwide have not initiated antiretroviral therapy (ART) [1]. The "90-90-90" Joint United Nations Programme on HIV/AIDS treatment program targets diagnosis of 90% of PLWH, ART treatment for 90% of diagnosed PLWH, and viral suppression for 90% of people receiving treatment. As of 2016 in South Africa, 86% of PLWH were aware of their status, 65% were on therapy, and 81% had achieved viral suppression [2]. Although this progress is remarkable, it has been challenging to bridge the gap between human immunodeficiency virus (HIV) testing and ART initiation.

Early diagnosis and treatment initiation are critical for improving outcomes and reducing transmission. Worldwide,

22%–49% of newly diagnosed HIV-infected individuals present at clinics with CD4 <200 cells/µL, and those diagnosed in late stages of infection have advanced immunosuppression, with a significantly greater risk of morbidity and mortality [3, 4]. In 2015, the World Health Organization (WHO) recommended that all HIV-infected persons initiate ART irrespective of CD4 count, and South Africa implemented this universal test-and-treat rule in September 2016. Two randomized controlled trials conducted in sub-Saharan Africa found that although the universal test-and-treat approach resulted in increased testing in this population, linkage to care and treatment adherence were still a problem [5, 6]. A better understanding of the risk factors of delay in presentation to HIV care and ART initiation may be crucial for ensuring success of HIV programs.

Definitions of different stages at presentation to HIV care have been recently defined in an effort to standardize data collection and reporting in various settings [7, 8]. "Late testing" is commonly expressed in terms of an AIDS-defining illness and/or CD4 T-cell counts ranging from 50 cells/µL to 350 cells/µL at the time of testing, with 200 cells/µL being the most frequently used criterion [9, 10]. "Delayed presentation" is a concept that measures the time between first HIV diagnosis and

presentation to clinical care, without regard to disease stage and severity [7]. Most studies of presentation to HIV care have not differentiated between people who present to the clinic for the first time with a low CD4 count (late testers) and people who present for testing or treatment having had a prior diagnosis of HIV (delayed presenters).

Because depression and anxiety disorders may be common among PLWH [11, 12], we hypothesized that delayed treatment-seeking behaviors of HIV-infected adults who know their HIV status may be associated with depression and anxiety. While an association between depression and low CD4 cell counts and treatment adherence has been described before [13, 14], there is limited understanding of the relationship between depression/anxiety and delayed care-seeking behavior among HIV-infected individuals. Therefore, we sought to determine whether depression and anxiety are risk factors for delayed presentation to HIV care among HIV-infected individuals in an HIV clinic in Umlazi, South Africa.

METHODS

Site and Participants
We conducted a prospective cohort study of HIV-infected adults in an urban township in KwaZulu-Natal, South Africa. We recruited patients presenting for HIV testing at the outpatient department of iThembalabantu Clinic in the Umlazi township from September 2013 to July 2016. Eligible participants were ≥18 years of age, presenting for voluntary HIV testing, and ART naive at the time of enrollment. We excluded females known to be pregnant. All participants provided written informed consent in either English or Zulu. The study was approved by the institutional review board (number 49563) of the University of Washington in Seattle and the Medical Research Ethics Committee of the University of KwaZulu-Natal in Durban (protocol number BF052/13).

Data Collection
Upon enrollment and before HIV testing, a research assistant collected information on sociodemographic and behavioral factors, HIV testing history, and knowledge of partner's HIV status using a standardized questionnaire. Additional questions assessed several known risk factors for late testing, including distance to the clinic and travel time. Questions about experienced/ anticipated stigma and stigmatizing attitudes were adapted from an HIV stigma scale validated in Uganda [15]. All responses to the questionnaire were self-reported. This was followed by HIV testing conducted by non-research clinic staff as per standard of care. For those who tested HIV positive, a research nurse performed routine clinical assessment for signs/symptoms of disease, a clinical examination, and baseline laboratory testing, including CD4 T-cell count. Collected blood samples were tested for CD4 count at the National Health Laboratory Service at Prince Mshiyeni Memorial Hospital.

Measurement of Depression and Anxiety
The main exposures of interest were depression and anxiety. We used the 9-item Patient Health Questionnaire (PHQ-9) scale to assess depression, which has been used before among HIV-infected populations in South Africa [16, 17], Kenya [18], and the United States [19]. Each response is scored on a 4-point Likert scale (0 for "not at all" to 4 for "nearly every day"), with all responses being summed into a severity score for each participant. We used the 7-item Generalized Anxiety Disorder scale (GAD-7) to measure anxiety. The anxiety severity score was calculated in a manner similar to the PHQ-9 scale. The depression and anxiety scores were analyzed using severity score cut-offs described for the PHQ-9 and GAD-7 scales, respectively [20, 21]. Depression was categorized as no depression (PHQ-9 score <5), mild to moderate depression (PHQ-9 score 5–14), or severe depression (PHQ-9 score >14). Anxiety was categorized as no anxiety (GAD-7 score <10) or generalized anxiety disorder (GAD-7 score ≥10). We administered questions related to depression, anxiety, and stigma before HIV testing to eliminate any bias that may arise from knowledge of the HIV test result.

Outcome Definitions
We differentiate between delayed presenters and late testers in this study. We calculated delay in care-seeking as date of enrollment in the study minus the date of first self-reported positive HIV test. A gap of >90 days between the first HIV-positive test and study enrollment was considered delayed presentation to care for the purpose of this study. HIV-infected participants were categorized as delayed presenters or late testers based only on their status at the time of enrollment.

We categorized HIV-care seeking behavior as follows:

- Delayed presenters: Participants who first tested positive for HIV >90 days prior to study enrollment, regardless of their CD4 count at enrollment.
- Late testers: Participants who tested positive at the time of study enrollment or ≤90 days prior to enrollment and had baseline CD4 count <200 cells/μL.
- Neither: Participants who tested positive for HIV at the time of study enrollment or ≤90 days prior to enrollment and had a baseline CD4 count >200 cells/μL.

Statistical Analysis
Univariate multinomial logistic regression models were used to identify independent risk factors associated with HIV care-seeking behavior. We measured the correlation between depression and anxiety using Pearson correlation coefficient. Separate logistic regression models were fit for depression and anxiety due to high correlation between them. Variables that were significantly associated with the outcome in univariate models were included in the final multivariable models. Age, sex, and stigma were hypothesized to be confounders in the

association of both depression and anxiety with HIV care-seeking behavior and were adjusted for in the multivariable models regardless of statistical significance in univariate models. We categorized age as ≤25 years, 26–35 years, 36–45 years, and ≥46 years. We broadly categorized stigma as "experienced stigma" and "stigmatizing attitudes." A positive response to at least 1 question indicative of either of these 2 categories classified a person as exposed to HIV-related stigma. All reported *P* values were 2-tailed, and a *P* value <.05 was considered statistically significant. We conducted analyses using SAS software version 9.4 (SAS Institute, Cary, North Carolina).

RESULTS

Cohort Characteristics

Of the 4170 participants enrolled, 1482 (36%) were HIV infected and met the inclusion criteria. Of these, 211 (14%) participants were missing information on baseline CD4 counts and were excluded. Among the 1271 participants that were included, 90 (7%) were delayed presenters, 372 (29%) were late testers, and 809 (63%) were neither (Figure 1).

Within the study cohort, about half (47%) were 26–35 years old, 756 (59%) were female, 796 (63%) had not completed high school, a majority (82%) had at least 1 child, and 96 (7%) were married. About half of the cohort was unemployed (56%), and 82% of the cohort earned <2000 South African rand (162 US dollars) per month. A majority of the participants (86%) lived within 5 km of the clinic and about 21% had to use public transit to travel to the clinic. Eight hundred thirty-seven participants (66%) had tested at least once for HIV before, and 113 (9%) reported having a positive HIV test before presenting for testing at the iThembalabantu clinic. The mean CD4 count was 294 cells/μL for delayed presenters, 101 cells/μL for late testers, and 447 cells/μL for the control group. Smoking and alcohol consumption was low in
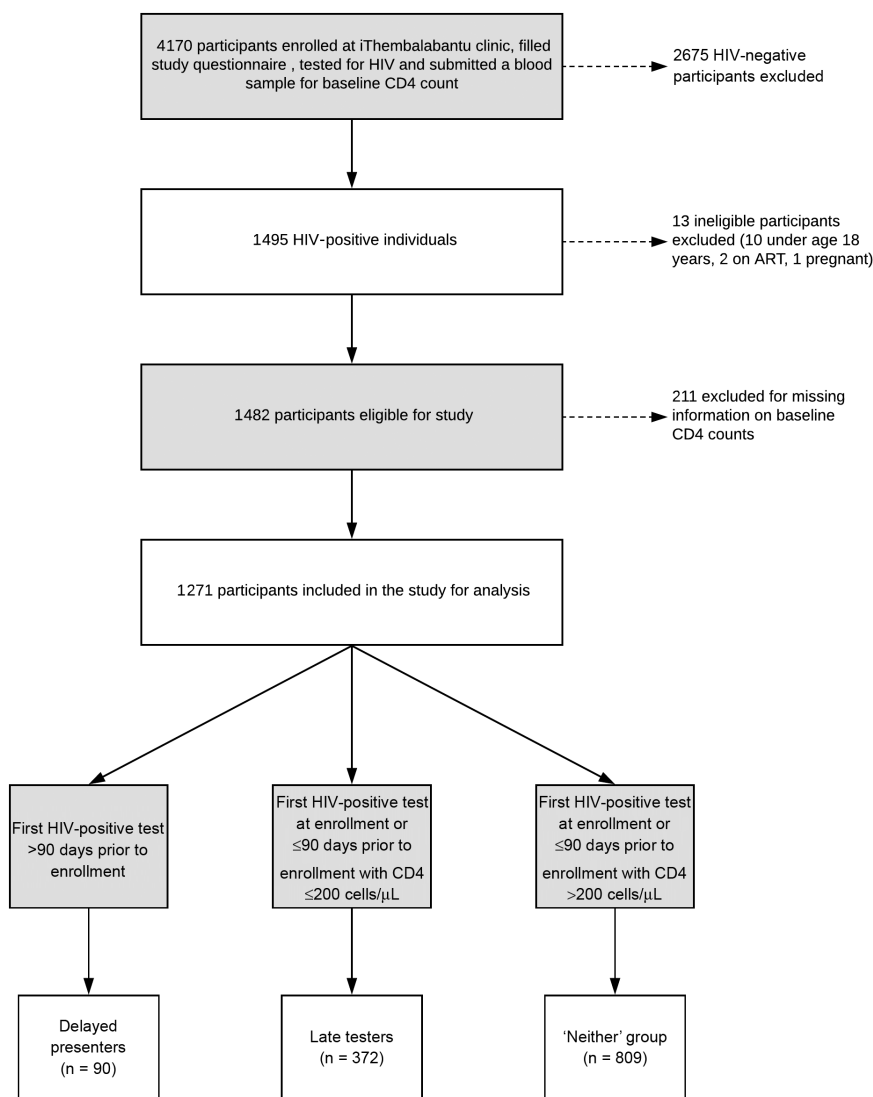

Figure 1. Flowchart of participants enrolled at the iThembalabantu clinic. Abbreviations: ART, antiretroviral therapy; HIV, human immunodeficiency virus.

this cohort (24% ever smoked, 35% ever consumed alcohol). About a third of the cohort had HIV-infected partners (29%), but more than half of the cohort (57%) did not know their partner's HIV status (Table 1). The proportion of delayed presenters declined significantly over time from 27% (46/172) in 2013 to 0% (0/172) in 2016, whereas the proportion of late testers increased moderately from 24% (42/172) in 2013 to 34% (58/172) in 2016.

Prevalence of Depression and Anxiety

The prevalence of mild to moderate depression in the study sample was 33% (n = 382) and that of severe depression was 3% (n = 36). The prevalence of generalized anxiety disorder was 9% (n = 117). Depression and anxiety were highly and positively correlated (Pearson correlation coefficient, $\rho = 0.75$) in this cohort.

Correlates of Delayed Presentation

In the univariate analysis comparing delayed presenters to the comparison ("neither") group, depression, anxiety, stigma, high income, and distance from clinic were significantly associated with delayed presentation (Table 2). Women had 40% greater odds of being delayed presenters, but this association was only moderately significant. Compared to HIV-infected individuals with no depression, the odds of delayed presentation were 1.6 times greater (95% confidence interval [CI], .9–2.8) for those with mild to moderate depression, and 3.6 times greater (95% CI, 1.2–10.2) for those with severe depression, after adjusting for calendar year, age, sex, stigma, distance from clinic, and income (Table 3). Participants with anxiety had odds of delayed presentation 2.3 times higher (95% CI, 1.3–4.2) compared to those with no anxiety (Table 3). Thus, severe depression and generalized anxiety were significantly associated with delayed presentation in our study. Calendar year, sex, stigma, and distance from clinic were still significantly associated with delayed presentation in multivariable models for both depression and anxiety.

Correlates of Late Testing

In the univariate analysis comparing late testers to the comparison group, only age, sex, and severe depression were significantly associated with late testing (Table 2). Compared to HIV-positive individuals with no depression, the odds of late testing were 1.3 times greater (95% CI, .9–1.8) for those with mild to moderate depression, and 2.2 times greater (95% CI, 1.01–4.8) for those with severe depression, after adjusting for calendar year, age, sex, stigma, distance from clinic, and income (Table 3). Odds of late testing were not significantly different (odds ratio, 1.3 [95% CI, .8–2.0]) among those with anxiety compared to those without anxiety (Table 3). Thus, in the multivariable models, severe depression was moderately significantly associated with late testing, but anxiety was not.

DISCUSSION

In this HIV-infected cohort in South Africa, people who were classified as delayed presenters for care were significantly more likely to have severe depression and generalized anxiety than patients who presented earlier, regardless of CD4 count. Late testing was not significantly associated with mild to moderate depression and anxiety and was weakly associated with severe depression. Other risk factors for delayed presentation included female sex, high income, and living far from the clinic. Brief mental health screening at presentation in these high-risk groups may improve enrollment and linkage in HIV treatment programs. This is in accordance with the new WHO recommendations for prevention and management of mental health conditions in HIV populations [22].

Few studies have explored the psychosocial barriers associated with HIV care-seeking behavior. Fear of HIV-related stigma and low perceived risk of infection have been shown to be associated with lower rates of testing [23–26]. A recent study in South Africa found that poor social support and mental health affected HIV testing behavior [27]. In other studies, depression and anxiety have been linked with lower CD4 cell counts and poor treatment adherence [28, 29], but not with testing behavior. To our knowledge, our study was the first to explore the association of depression and anxiety with HIV care-seeking behavior, which we studied in a large cohort of South Africans presenting for HIV testing in a province with high HIV prevalence. Prior studies addressing psychosocial barriers also did not distinguish between delayed presenters and late testers. This study underscores the importance of distinguishing between types of delayed care-seeking behaviors, as different risk factors might be associated with them. Our findings indicate that programs may benefit from conducting a brief depression and anxiety screening assessment to identify those at risk of delayed presentation and may want to have more frequent contact with high-risk groups or offer same-day ART initiation to them.

We hypothesized that delayed presenters with a prior HIV-positive test may experience increased psychological distress or respond with denial, which might cause them to delay initiating treatment by several months, and our study results confirm this. The fear and stigma associated with disclosing their HIV status to their family or the community might also demotivate individuals from seeking treatment in a timely manner [4]. Domestic violence is another important risk factor for HIV among women in this region that may prevent timely treatment [30] as well as cause traumatic stress, which can lead to depression [31]. We found weak evidence of association between late testing and severe depression in our study and no association between late testing and anxiety. This might be because only 7 (2%) of late testers had a prior positive HIV diagnosis. The fear and stigma related to a positive diagnosis could, thus, be lower in this group, which could have resulted in low prevalence of depression and anxiety. While some studies have shown

Table 1.   Cohort Characteristics of Human Immunodeficiency Virus-Infected Adults, by Outcome Status

Characteristic	Total	Delayed Presenters	Late Testers	Control	P Value[b]
Total	1271	90	372	809	
Sociodemographic factors					
Year enrolled					
2013	172 (13.5)	46 (51.1)	42 (11.3)	84 (10.4)	**<.001**
2014	478 (37.6)	34 (37.8)	140 (37.6)	304 (37.5)	
2015	449 (35.4)	10 (11.1)	132 (35.5)	307 (38.0)	
2016	172 (13.5)	0 (0.0)	58 (15.6)	114 (14.1)	
Age, y					
≤25	214 (16.8)	12 (13.3)	43 (11.6)	159 (19.6)	**.013**
26–35	600 (47.2)	43 (47.8)	170 (45.7)	387 (47.8)	
36–45	311 (24.4)	23 (25.6)	104 (28.0)	184 (22.7)	
≥46	146 (11.4)	12 (13.3)	55 (14.8)	79 (8.6)	
Sex					
Female	756 (59.4)	66 (73.3)	176 (47.3)	514 (63.5)	**<.001**
Education					
Less than high school	796 (62.6)	54 (60.0)	245 (65.9)	497 (61.4)	**.0003**
Employment status					
Unemployed	708 (55.6)	58 (64.4)	202 (54.3)	448 (55.3)	.3
Have children					
Yes	1044 (82.3)	79 (87.8)	297 (79.8)	668 (82.8)	.6
Income, ZAR/mo[c]					
<2000	1031 (82.5)	63 (70.0)	305 (82.0)	663 (83.4)	.06
Marital status					
Unmarried, widowed, or divorced	1175 (92.4)	84 (93.3)	347 (93.3)	744 (92.0)	.5
Travel					
Use public transit or other	266 (20.9)	22 (24.4)	79 (21.2)	165 (20.5)	.3
Distance traveled to clinic					
<5 km	1095 (86.2)	66 (73.3)	328 (88.2)	701 (86.7)	**<.0001**
HIV testing history					
Had a prior HIV test	837 (65.8)	90 (100.0)	216 (58.1)	531 (65.6)	**<.001**
Had a prior HIV-positive test	113 (8.8)	90 (100.0)	7 (0.8)	16 (2.0)	**<.001**
Average No. of times tested for HIV prior to enrollment[a]	3.5 (2.3)	2.8 (1.9)	3.04 (1.8)	3.7 (2.4)	**<.001**
Mean CD4 count at enrollment[a]	335 (239)	294 (214)	101 (58)	447 (212)	**<.001**
Behavioral factors					
Smoking					
Ever smoker	307 (24.2)	24 (26.7)	98 (26.3)	185 (23.0)	.6
Alcohol					
Ever consumed alcohol	441 (34.8)	33 (36.7)	139 (37.4)	269 (33.4)	**.0015**
Partner's HIV status					
No/unknown	729 (57.5)	42 (46.7)	228 (61.3)	459 (56.8)	**.013**
Yes negative	170 (13.3)	17 (18.9)	41 (11.1)	112 (13.8)	
Yes positive	369 (29.0)	31 (34.4)	101 (27.1)	237 (29.3)	
Depression					
Mild to moderate	382 (30.0)	51 (56.7)	116 (31.2)	215 (26.5)	**<.001**
Severe	36 (2.8)	7 (7.8)	14 (3.8)	15 (1.9)	
Anxiety					
Yes	117 (9.2)	20 (22.2)	37 (9.9)	60 (7.4)	**<.001**
Stigma					
Stigmatizing attitudes	232 (18.2)	25 (27.7)	69 (18.5)	138 (17.0)	**.04**
Experienced stigma	228 (17.9)	32 (35.5)	62 (16.7)	134 (16.6)	**<.001**

Data are presented as No. (%) unless otherwise indicated. Statistically significant *P*-values are in bold.

Abbreviations: HIV, human immunodeficiency virus; ZAR, South African rand.

[a]Continuous variables are summarized as mean (standard deviation) of the variable. The *P* values are for analysis of variance (ANOVA) test comparing means for ≥2 levels.

[b]For categorical variables, *P* values are for χ² test comparing proportions in each group. For continuous variables, *P* values are for ANOVA tests comparing group means.

[c]1 ZAR = 0.08 US dollars.

Table 2. Univariate Correlates of Delayed Presenters and Late Testers[a] (N = 1271)

Characteristic	Delayed Presenters OR (95% CI)	P Value	Late Testers OR (95% CI)	P Value
Enrollment year				
2013	1	…	1	…
2014	0.2 (.1–0.3)	<.001	0.9 (.6–1.4)	.7
2015	0.06 (.03–0.1)	<.001	0.9 (.5–1.3)	.5
2016	…	…	1.02 (.6–1.6)	.9
Age, y				
≤25	1	…	1	…
26–35	1.4 (.7–2.8)	.2	1.6 (1.1–2.3)	.01
36–45	1.6 (.8–3.4)	.1	2.1 (1.3–3.1)	**<.001**
≥46	2.0 (.8–4.6)	.1	2.6 (1.6–4.1)	**<.001**
Sex				
Female	1	…	1	…
Male	0.6 (.4–1.0)	.06	1.9 (1.5–2.5)	**<.001**
Education				
Less than high school	1	…	1	…
High school or greater	1.1 (.7–1.7)	.8	0.8 (.6–1.1)	.13
Income, ZAR/mo[b]				
<2000	1	…	1	…
≥2000	2.0 (1.2–3.3)	**.006**	1.0 (.7–1.4)	.9
Children				
No	1	…	1	…
Yes	1.5 (.7–2.8)	.2	0.8 (.6–1.1)	.2
Employment				
No	1	…	1	…
Yes	0.7 (.4–1.1)	.09	1.0 (.8–1.3)	.7
Marital status				
No	1	…	1	…
Yes	0.8 (.3–1.9)	.6	0.8 (.5–1.3)	.4
Travel				
Walk	1	…	1	…
Use public transit or other	0.8 (.5–1.3)	.4	0.9 (.7–1.3)	.8
Distance	1	…	1	…
<5 km from clinic				
≥5 km from clinic	2.4 (1.4–3.9)	**<.001**	0.8 (.6–1.3)	.5
Smoking				
Never smoker	1	…	1	…
Ever smoker	1.2 (0.7–1.9)	.4	1.2 (.9–1.6)	.2
Alcohol				
Ever consumed alcohol	1	…	1	…
Never consumed alcohol	1.1 (.7–1.8)	.5	1.2 (.9–1.5)	.2
Partners' HIV status				
No/unknown	1	…	1	…
Yes/HIV negative	1.6 (.9–3.0)	.09	0.7 (.5–1.1)	.1
Yes/HIV infected	1.4 (.9–2.3)	.1	0.8 (.6–1.1)	.3
Depression				
No depression	1	…	1	…
Mild to moderate[c]	4.3 (2.7–6.9)	**<.001**	1.3 (.9–1.7)	.06
Severe[d]	8.4 (3.2–22.2)	**<.001**	2.2 (1.1–4.7)	**.03**
Anxiety[e]				
No	1	…	1	…
Yes	3.6 (2.0–6.2)	**<.001**	1.4 (.9–2.1)	.1
Stigma[f]				
No	1	…	1	…
Yes	3.4 (2.2–5.3)	**<.001**	1.1 (.8–1.5)	.5

Statistically significant *P*-value are in bold.

Abbreviations: HIV, human immunodeficiency virus; ZAR, South African rand.

[a]Comparison group consists of individuals who presented to the clinic within 3 months of a positive HIV test with a CD4 count >200 cells/μL.

[b]1 ZAR = 0.08 US dollars.

[c]Mild to moderate depression: 9-item Patient Health Questionnaire (PHQ-9) score 5–13.

[d]Severe depression: PHQ-9 score ≥14.

[e]Anxiety: 7-item Generalized Anxiety Disorder scale score ≥10.

[f]Stigma was recategorized as a binary yes/no variable and defined as participants who experienced stigma and/or stigmatizing attitudes.

Table 3. Multivariable Analyses for Association Between Depression/Anxiety and Delayed Care-Seeking Behavior[a]

Characteristic	Delayed Presenters aOR[b] (95% CI)	P Value	Late Testers aOR[b] (95% CI)	P Value
Depression				
No depression	Ref	…	Ref	…
Mild to moderate depression[c]	1.6 (.9–2.8)	.08	1.3 (.9–1.8)	.08
Severe depression[d]	3.6 (1.2–10.2)	**.01**	2.2 (1.01–4.8)	**.04**
Anxiety[e]				
No anxiety	Ref	…	Ref	…
Anxiety	2.3 (1.3–4.2)	**.006**	1.3 (.8–2.0)	.3

Statistically significant *P*-values are in bold.

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval.

[a]Two separate logistic models for depression and anxiety due to high correlation between them.

[b]Models are adjusted for calendar year, age, sex, stigma, income, and distance from clinic.

[c]Mild to moderate depression: 9-item Patient Health Questionnaire (PHQ-9) score 5–14.

[d]Severe depression: PHQ-9 score ≥14.

[e]Anxiety: 7-item Generalized Anxiety Disorder scale score ≥10.

that depression may inhibit HIV testing, the exact nature of the relationship between testing-related fear and distress and depression is unclear [4, 32]. More research explicitly defining the mechanism through which depression/anxiety affects late testing among undiagnosed individuals is warranted.

In this cohort, the prevalence of depression (33%) and anxiety (9%) were comparable to those reported in other studies in Africa [33–35]. Studies that have examined demographic and social factors associated with a general category of late presentation for HIV care have found older age, foreign origin [25], low socioeconomic status, unemployment [36], doubting partners' faithfulness [25, 36], counseling at time of first positive test [8], and being male [36, 37] as predictive of care-seeking behavior. Association between more perceived stigma and late presentation has also been described [38]. We too found older age, female sex, and HIV-related stigma to be associated with delayed presentation. Older age and male sex were associated with late testing, which confirms the findings of other studies.

A total of 113 (9%) participants presented at the iThembalabantu clinic for a voluntary HIV test despite having a prior positive HIV diagnosis, and 80% of them (90/113) were delayed presenters. While there is little research around repeat testing behavior of HIV-infected individuals, some reasons could be doubts about their HIV diagnosis at first test, lack of access to ART at first facility, stigma-related factors, or transportation issues [39].

While late testing remained unchanged during the period of enrollment, South Africa implemented the universal test-and-treat strategy in September 2016, which was after study enrollment ended. This may lead to a decrease in late testing behavior [40].

Our study had several strengths and limitations. We reduced the potential for bias of our outcomes by administering the depression and anxiety questionnaires before testing for HIV. However, the cross-sectional study design precludes ascertainment of temporality and assertions of causality. About 14% of participants were excluded from the study because they did not have a laboratory result for baseline CD4 count. We assumed that these data are missing completely at random and performed a complete case analysis. Participants self-reported details of previous HIV diagnosis that allowed us to classify them as delayed presenters. Recall bias or social desirability bias may result in an underestimation of the number of delayed presenters. We were unable to assess and control for previously reported risk factors either because the data were not collected in our questionnaire (foreign origin, perception of partner's faithfulness, domestic violence) or were only collected on a subset of participants (perception of HIV acquisition), or the prevalence of the risk factor in our cohort was negligible (drug use) [4, 8, 24]. In our cohort, there is little variation in drug use and country of origin across exposure groups, so they are unlikely to be important confounders. Domestic violence is a potential confounder of the association between depression and HIV care-seeking behavior that may have biased our findings. Finally, while we did measure stigma, it has been challenging to obtain a standardized and validated measure of HIV-related stigma in this population, despite recent efforts [15].

In conclusion, these findings suggest that interventions aimed at reducing delays in engagement in HIV care should acknowledge that persons with depression and anxiety are at higher risk of delayed presentation for care. HIV testing programs could do brief anxiety and depression screening, engage in closer follow-up, and encourage same-day HIV treatment initiation to reduce delays in HIV care linkage.

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